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GB 1252925
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H1B
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(54) **Assembling Electric Batteries**

(57) The invention relates to a method of assembling electric batteries in which a pack of plates 13 interleaved with separators 12 is compressed, for instance by wedging fingers 30, so as to reduce its thickness perpendicular to the plane of the plates and is positively inserted into a compartment in a battery container. The invention also relates to an apparatus for carrying out the method.

Use of the method enables plate packs to be a tight fit within a battery container which reduces their susceptibility to vibrate.

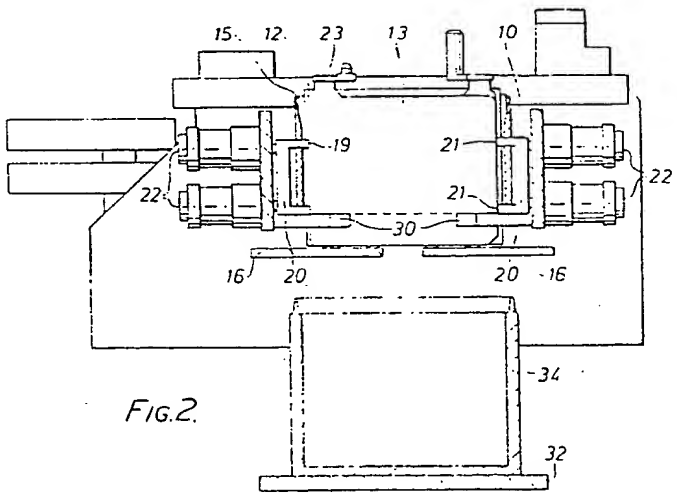

FIG.2.

GB 2 013 964 A

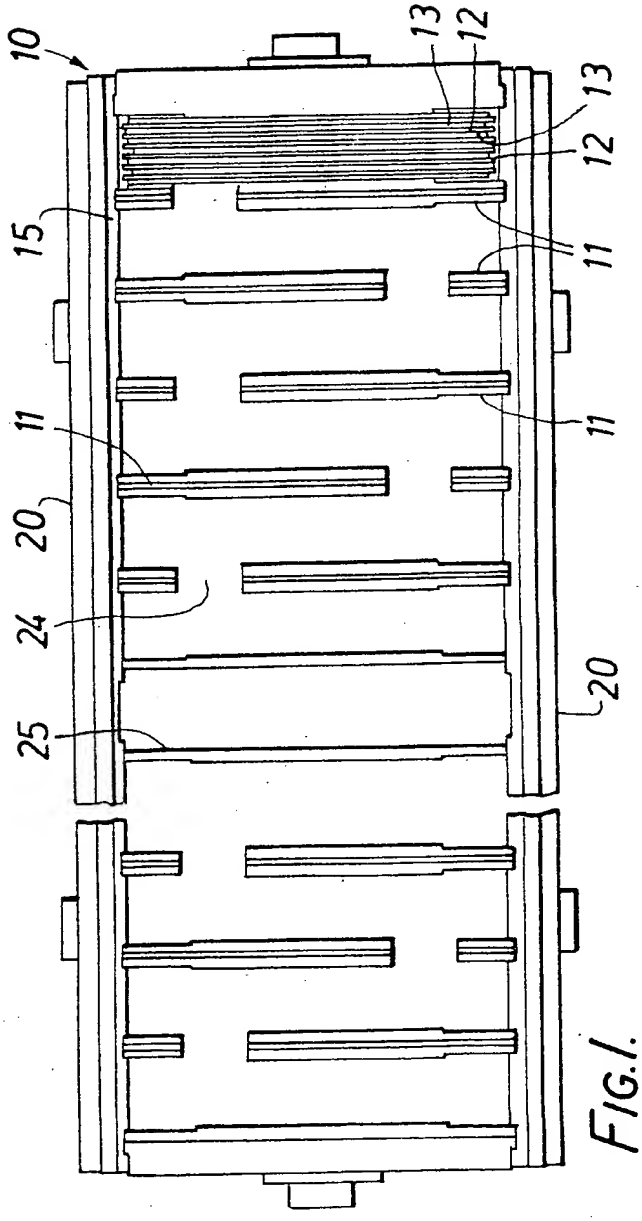

FIG.1.

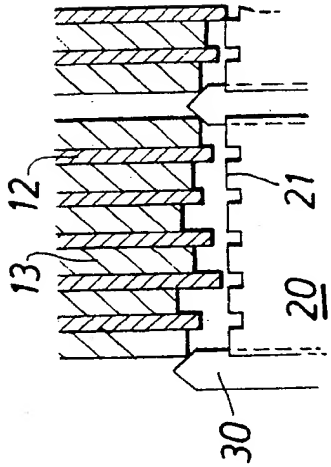

FIG.3.

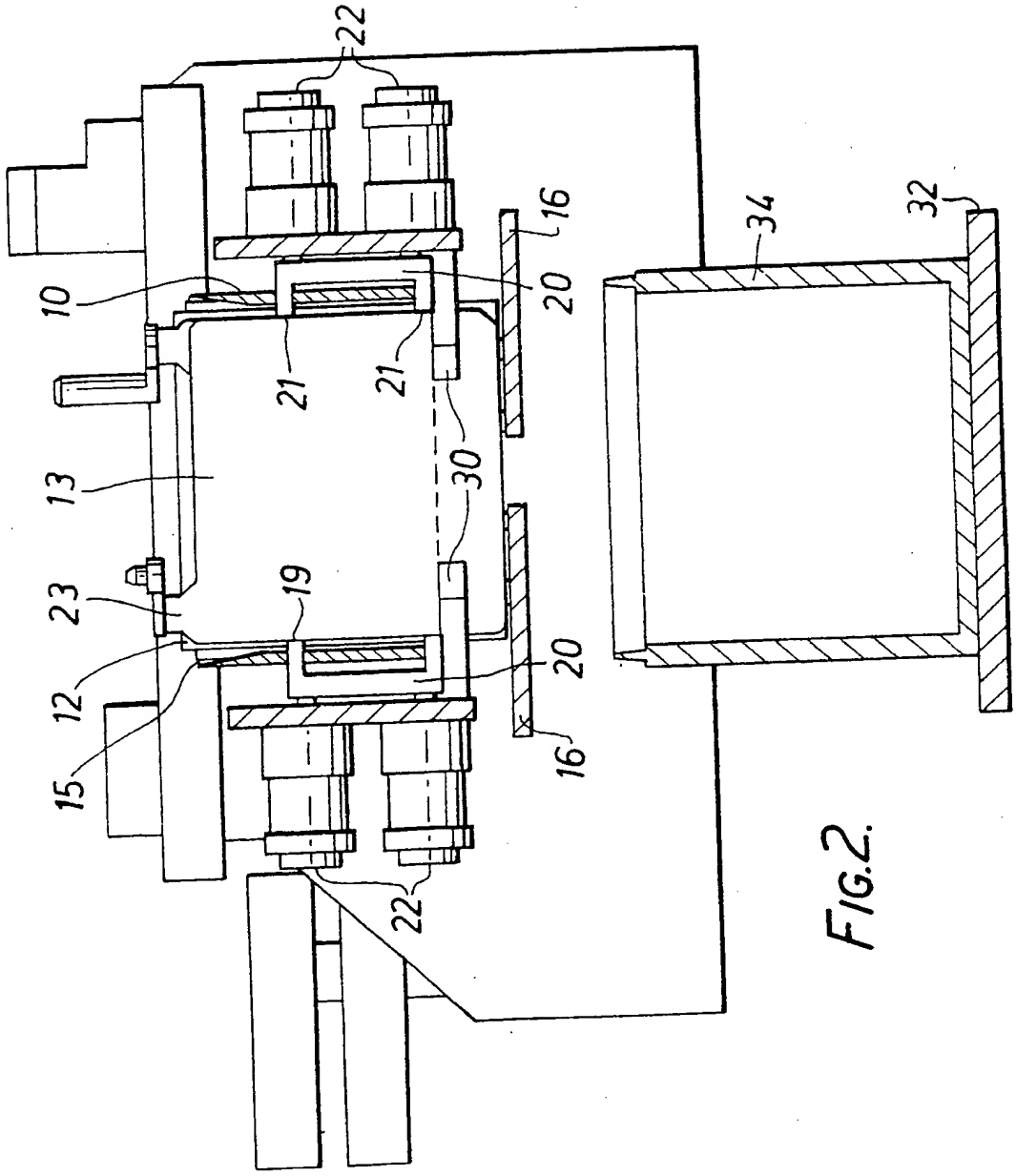

FIG.2.

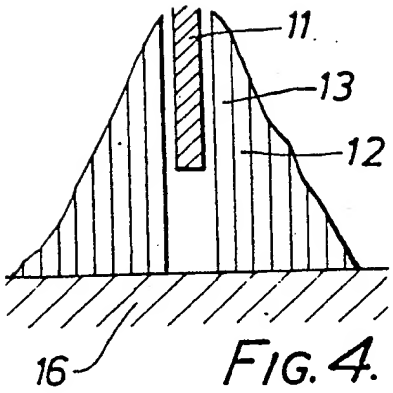

FIG. 4.

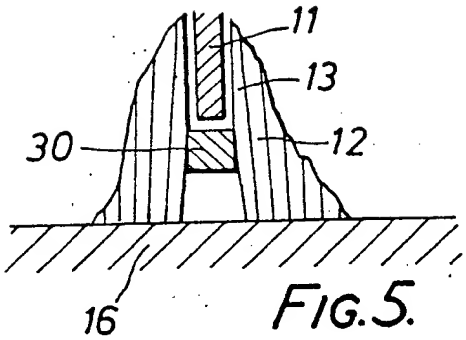

FIG. 5.

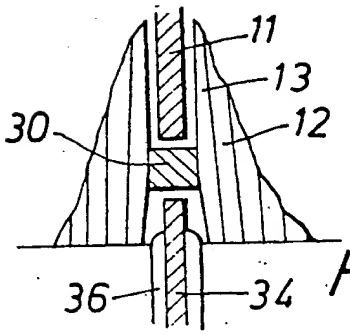

FIG. 6.

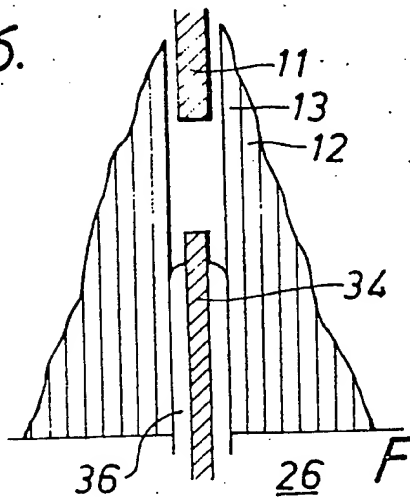

FIG. 7.

SPECIFICATION

Assembling Electric Batteries

The invention relates to the assembly of electric batteries and in particular to the insertion of packs of flat battery plates into a battery container.

According to one aspect of the present invention a method of assembling electric batteries includes the steps of compressing a pack of flat positive and negative battery plates interleaved with separators so as to reduce its thickness perpendicular to the plane of the plates, at least at its lower edge, and positively inserting the lower edge into a compartment in a battery container.

Preferably the pack is assembled in a jig and compressed while supported in the jig, and then held by the compressing means while the support is removed and the battery container is fitted over the compressed edge of the pack.

The method is particularly applicable to the simultaneous insertion of two or more plate packs into a respective compartment in a multi-cell electric battery container, in which case the jig is provided with partitions which correspond to the partitions of the battery container.

In a preferred form of the invention the partitions in the jig terminate short of the bottom of the jig compartments and the compression is applied by causing wedging fingers to project proud of the side walls of the jig on each side of each pack of plates so as to engage and compress it.

After the lower edges of the plates have been inserted into the battery container, the wedging fingers are released. Depending on how tight the plates are in their respective compartments they will either fall in, or in accordance with a further feature of the invention, they may be pushed in, either manually or mechanially. In the latter case the plates may be pushed in prior to the lowering of the container by a pusher which extends through the jig, or subsequent to the lowering of the container.

The method may also include the step of causing centralising fingers to project proud of the side walls of the jig to engate the plates and centralise them with respect t the separators. This step is preferably carried out simultaneously with the step of causing the wedging fingers to engage the plate packs.

The method may also include the further step of moving mould portions relative to one another so as to form a channel about the plate lugs, and casting a plate strap and preferably also, where two or more packs are to be inserted, an intercell connector.

The invention also embraces an apparatus for carrying out the method and according to a further aspect of the present invention an apparatus for assembling packs of flat electric battery plates in a battery container includes a jig having a compartment for each plate pack, a support for a pack in each compartment, compressing means arranged to compress each pack in a direction perpendicular to its plates, at least along its lower edge, and to hold the pack, and means for removing the support and causing the compressed lower edge to enter a respective compartment of a battery container.

The jig may have a removable floor constituting the support for the or each pack.

Preferably the apparatus also includes centralising fingers which may be moved into a position in which they engage the edges of the plates so as to centralise them with respect to the separators. Preferably the wedging fingers and centralising fingers are connected together and actuated by a common control.

The jig may be similar to that described in British Patent No. 1252925. This prior specification describes a jig into which packs of positive and negative plates interleaved with separators are inserted. The plates are centralised with respect to the separators and plate straps and intercell connectors are formed. The bottom of the jig is then slid aside and the interconnected plate packs are allowed to drop into a battery container below.

Whilst effective, this method has two disadvantages. Firstly, a certain proportion of plate packs do not enter their respective battery compartments instead the plate packs may fall astride an intercell partition. This can damage the plate packs and the battery container and lead to a lot of wasted time. If the failure rate is to be kept acceptably low the plate pack must be considrably smaller than the battery compartment into which it is to fall. This results in the plate pack being a relatively loose fit in the battery and subject to vibration. Vibration tends to shake active material loose from the plates and weaken the intercell seal, thus reducing the service life of the battery.

Use of the method in accordance with the invention obviates these problems because a positive insertion of the plate groups into the battery container results in no waste of plate groups and containers due to a plate pack straddling a partition. Compression of the plate packs facilitates the insertion of the lower edge of the plate pack, and also enables the plates to be a tight fit within the battery container thus reducing the effect of vibration on the service life of the battery.

Further features and details of the invention will be apparent from the following description of one specific embodiment which is given by way of example, with reference to the accompanying diagrammatic drawings, in which:–

Figure 1 is a plan view of an assembly jig;

Figure 2 is a vertical section through the jig with the battery plates in it transverse to its length;

Figure 3 is a diagrammatic scrap plan sectional view prior to enagement of the plates and separators by the centralising fingers and wedging fingers; and

Figure 4 to 7 are scrap vertical sections on a plane parallel to the length of the jig showing successive steps in the method.

The jig is for assembling packs of plates and separators for one or more 6 to 12 volt lead-acid batteries and is of the general type described in British Patent Specification No. 1252925. The jig comprises a box 10 divided by paritions 11 into a

number of compartments corresponding to the number of cells in one or more multicell batteries. Each compartment is of a size to receive a pack of separate alternate positive and negative plates 13 interleaved with separators 12, for instance of microporous PVC. The upper parts of the walls of each compartment are flared outwards at 15 to provide a lead-in to guide the pack into the compartment.

The bottom of the jig is formed by a pair of retractable sliding doors 16 to support the plate packs. The sliding doors 16 are actuated by a pair of pneumatic rams (not shown) at their ends.

The partitions 11, and the side and end walls of the jig terminate a little above the sliding doors as shown in Figures 2 and 4. Beneath each point where a partition or end wall of the jig joins with one of the side walls there is a wedging finger 30 which may be forced inwardly by means of a pneumatic ram 22. The function of these wedging fingers will be described in more detail below.

As described in the prior specification No. 1252925 each side wall of the jig is formed with a horizontal slot 19 extending its full length. Each slot 19 is occupied by centraliser teeth or fingers 21 carried by the upper flange of a channel shaped member 20. The lower flange of the member 20 also carries fingers 21 immediately beneath the lower edge of the side walls of the jig. The channel member on each side of the jig is connected to the wedging fingers 30 and is also acted on by the rams 22 so as to move the fingers 21 from a position in which they do not project into the slots 19 to a position in which they project inwardly from the side walls. Each finger 21 is vertically aligned with a battery plate 13 so that when the fingers are moved inwards they will engage the opposite edges of the plates at vertically-spaced positions and will centre the plates with respect to the separators 12.

The jig also includes two sets each of two movable mould portions (not shown) namely a comb portion having slots through which vertical plate lugs 23 may project, and an upstanding side wall, and a wall portion, the portions being relatively movable so as to form a channel mould into which the plate lugs 23 project so that a plate strap may be formed by a process known as "burning" which comprises melting lead, or introducing molten lead, into the channels, as described in the prior specification referred to. The positive lugs on one plate pack are connected to the negative lugs of an adjacent plate pack by an intercell connector which is also cast in situ, and passes through a gap 24 formed in the partitions 11.

Beneath the jig is a lifting table 32 which may be moved relative to the jig by pneumatic rams which are not shown. In use the lifting table carries one or more battery containers 34 which may be raised to a level above that of the sliding doors 16 after the sliding doors have been retracted.

In use, therefore, a pack of flat positive and negative plates 13 interleaved with separators 12 is inserted into each compartment of the jig. The fingers 21 are caused to project inwards thus centering the plates with respect to the separators which project beyond the plates in all direction by about 2mm so as to reduce the risk of short circuits between the plates. The two portions of each set of moulds are now moved towards each other around a respective line of plate lugs 23. Combined plate straps and intercell connectors are formed by melting lead in the channel moulds. After solidification of the lead the sets of moulds are again retracted.

The six compartments to the right of the parition 25 in Figure 2 hourse the six packs of plates which are to form one battery, and are to be inserted into the battery container. They are held together as a single unit by the intercell connectors and plate straps and are supported by the sliding doors 16, as shown in Figure 4. Simultaneous with the inward movement of the centralising fingers 21, the wedging fingers 30 are moved inwardly to the position best seen in Figure 2 in which they project inwardly from the side wall of the jig. As seen in Figure 3 the width of each finger 30, as seen in plan, is greater than that of the partition 11 and each plate pack is therefore compressed slightly at its lower edge by virtue of the resilience of the separators, as seen in Figure 5.

The sliding doors 16 are now opened, the plate packs remaining held in position by their engagement with the centralising fingers 21 and the wedging fingers 30. The lower edges of the plate packs are left exposed because the partitions 11 of the jig terminate above the level of the sliding doors 16. A battery container 34 beneath the jig is now lifted upwards on the lifting table 32 until the walls of the container are adjacent the wedging fingers 30 so that the lower edge of each plate pack is introduced into a respective compartment 26 in the battery container as seen in Figure 6. The centralising fingers 21 and the wedging fingers 30 are now retracted. If the plate packs are a relatively loose fit in their respective container compartments they will fall to the bottom of the battery container and the lifting table is then lowered and the battery removed. If, however the plate packs are a tight fit within their respective battery compartments it will be necessary to push them mechanically into the container. This may be done by a mechanical push-through which extends through the compartments of the jig and engages the upper edges of the plates. Alternatively the battery container may be removed from the jig with the plates projecting from it and the plates may be subsequently pushed down either by hand, or mechanically.

In one particular example each pack has a nominal thickness of 51 mm while the distance between the inner faces of vertical ribs 36 on the partitions of the battery container is 50.2 mm at the bottom of the container; each plate pack is compressed by the wedging fingers so that it has to be finally forced into the container to be a snug fit.

The plate packs may thus be made a tighter fit within the battery container than was previously the case, thus reducing vibration of the plates and the possibility of the intercell seal failing and of active material being shaken out of the plates. This leads to an increase in the service life of the battery.

It will be appreciated that a great number of modifications may be made to the method described

above. For instance the plate packs may be compressed over a greater proportion of their area, for instance by providing a greater number of wedging fingers or by providing the partitions of the jig as double-walled partitions whose two walls may be moved apart, for instance by rotation of a cam.

Furthermore the order of the steps in the method may be altered. For instance the sliding doors 16 may be opened before the "burning" operation takes place, the plate packs being held in position by the centralising fingers and wedging fingers. This permits the battery container to be raised at the same time as the "burning" process thus slightly shortening the cycle time.

CLAIMS

1. A method of assembling electric batteries including the steps of compressing a pack of flat positive and negative battery plates interleaved with separators so as to reduce its thickness perpendicular to the plane of the plates, at least at its lower edge, and positively inserting the lower edge into a compartment in a battery container.

2. A method as claimed in Claim 1 in which the pack is assembled in a jig and compressed while supported in the jig, and then held by the compressing means while the support is removed and the battery container is fitted over the compressed edge of the pack.

3. A method as claimed in Claim 2 in which two or more plate packs are simultaneously inserted into a respective compartment in a multi-cell electric battery container, the jig being provided with partitions which correspond to the partitions of the battery container.

4. A method as claimed in Claim 3 in which the partitions in the jig terminate short of the bottom of the jig compartments and the compression is applied by causing wedging fingers to project proud of the side walls of the jig on each side of each pack of plates so as to engage and compress it.

5. A method as claimed in any one of the preceding Claims which further includes the steps of withdrawing the compressing means after the lower edge of the or each plate pack has been inserted into the battery container and then pushing the or each plate pack into the container.

6. A method as claimed in any one of Claims 2 to 5 including the step of causing centralising fingers to project proud of the side walls of the jig to engage the plates and centralise them with respect to the separators.

7. A method as claimed in Claim 6 when dependent on Claim 4 or Claim 5 in which the centralising step is carried out simultaneously with the step of causing the wedging fingers to engage the plate packs.

8. A method as claimed in any one of the preceding Claims which includes the further step of moving mould portions relative to one another so as to form a channel about the plate lugs, and casting a plate strap.

9. A method as claimed in Claim 8 when dependent on Claim 3 which includes casting one or more intercell connectors.

10. A method of assembling an electric battery substantially as herein described with reference to the accompanying drawings.

11. Apparatus for assembling packs of flat electric battery plates in a battery container including a jig having a compartment for each plate pack, a support for a pack in each compartment, compressing means arranged to compress a pack in a direction perpendicular to its plates, at least along its lower edge, and to hold the pack, and means for removing the support and causing the compressed lower edge to enter a respective compartment of a battery container:

12. Apparatus as claimed in Claim 11 in which the jig has a removable floor constituting the support for the or each pack.

13. Apparatus as claimed in Claim 11 or Claim 12 including wedging fingers adapted to project proud of the side walls of the jig on each side of the or each pack of plates so as to engage and compress it.

14. Apparatus as claimed in any one of Claims 11 to 13 including centralising fingers which may be moved into a position in which they engage the edges of the plates so as to centralise them with respect to the separators.

15. Apparatus as claimed in Claims 13 and 14 in which the wedging fingers and centralising fingers are connected together and actuated by a common control.

16. Apparatus substantially as herein described with reference to the accompanying drawings.

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